FEDOR SHMAROV

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PERSONAL PROFILE

I am an enthusiastic and motivated researcher with a strong background in formal verification and model checking. Currently I am working on a project sponsored by the Rosetrees Trust where I perform mathematical modelling of ultraviolet phototherapy for treating psoriasis and apply machine learning techniques to clinical data for designing personalised treatments.

WORK EXPERIENCE

Newcastle University, UK *October 2017 - present*
Research Associate in the School of Computing
Project Title: Personalised ultraviolet B (UVB) treatment of psoriasis through biomarker integration with computational modelling of psoriatic plaque resolution
Principal Investigators: Dr Paolo Zuliani and Prof Nick Reynolds
Sponsor: Rosetrees Trust

EDUCATION

Newcastle University, UK *September 2013 - January 2018*
Ph.D. in Computing Science
Thesis Title: Probabilistic Bounded Reachability for Stochastic Hybrid Systems
Supervisor: Dr Paolo Zuliani
Summary: I developed novel methods combining formal verification techniques and statistical model checking for probabilistic reachability analysis of stochastic parametric hybrid systems. I implemented these methods in the tool called ProbReach (https://github.com/dreal/probreach).

Newcastle University, UK *September 2012 - August 2013*
M.Sc. (with Distinction) in Advanced Computer Science
Average grade: 87.28 out of 100
Awards: The Philip Merlin prize from the School of Computing Science for best dissertation by an MSc taught student 2012-2013.

Tambov State Technical University, Russia *September 2007 - July 2011*
B.Sc. (with Honours) in Information Science and Computer Technology
Average grade: 5.0 out of 5.0

PUBLICATIONS

Work in progress

1. N. Watson, N. Wilson, **F. Shmarov**, P. Zuliani, G. Smith, N.J. Reynolds, and S.C. Weatherhead. "Towards predicting response to phototherapy in psoriasis using clinical and serum biomarkers with machine learning techniques".
2. **F. Shmarov**, P. Zuliani, G. Smith and N.J. Reynolds. "Modelling of Psoriasis Area Severity Index through ODE remodelling of UVB therapy for psoriasis".
3. **F. Shmarov**, P. Zuliani. "Probabilistic Bounded Reachability for Stochastic Parametric Hybrid Systems".

Under review

4. **F. Shmarov**, S. Soudjani, N. Paoletti, E. Bartocci, S. Lin, S.A. Smolka, and P. Zuliani. "Automated Synthesis of Safe Digital Controllers for Sampled-Data Stochastic Nonlinear Systems". *IEEE Access.*

5. M. Vasileva, **F. Shmarov**, and P. Zuliani. "Probabilistic Reachability for Uncertain Stochastic Hybrid Systems via Gaussian Processes". *18th ACM-IEEE International Conference on Formal Methods and Models for System Design.*

Conferences

6. A. Abate, H. Blom, N. Cauchi1, J. Delicaris, S. Haesaert, A. Hartmanns, M. Khaled, A. Lavaei, C. Pilch, A. Remke, S. Schupp, **F. Shmarov**, S. Soudjani, A. Thorpe, A.P. Vinod, B. Wooding, and P. Zuliani. "ARCH-COMP20 Category Report: Stochastic Models". *To appear in the proceedings of the 7th International Workshop on Applied Verification of Continuous and Hybrid Systems (ARCH20).*

7. **F. Shmarov**, N. Paoletti, E. Bartocci, S. Lin, S. Smolka, and P. Zuliani. "SMT-based Synthesis of Safe and Robust PID Controllers for Stochastic Hybrid Systems". *Proceedings of the 13th International Haifa Verification Conference (HVC 2017).* 2017, pp. 131–146.

8. **F. Shmarov**, and P. Zuliani. "Probabilistic Hybrid Systems Verification via SMT and Monte Carlo Techniques" in *HVC*. LNCS, vol. 10028, 2016, pp. 152–168. ***(Presented by me at the conference.)***

9. **F. Shmarov**, and P. Zuliani. "SMT-based Reasoning for Uncertain Hybrid Domains," in *AAAI-16 Workhop on Planning for Hybrid Systems, 30th AAAI Conference on Artificial Intelligence*, 2016, pp. 624–630. ***(Presented by me at the workshop.)***

10. C. Madsen, **F. Shmarov**, and P. Zuliani. "BioPSy: an SMT-based Tool for Guaranteed Parameter Set Synthesis of Biological Models," in *CMSB*, ser. LNCS, vol. 9308, 2015, pp. 182–194.

11. **F. Shmarov**, and P. Zuliani. "ProbReach: a Tool for Guaranteed Reachability Analysis of stochastic parametric hybrid systems," in *Symbolic and Numerical Methods for Reachability Analysis, 1st International Workshop, SNR 2015*, ser. EPiC Series in Computing, S. Bogomolov and A. Tiwari, Eds., vol. 37, 2015, pp. 40–48. ***(Presented by me at the workshop.)***

12. **F. Shmarov**, and P. Zuliani. "ProbReach: Verified Probabilistic Delta-Reachability for stochastic parametric hybrid systems," in *HSCC*. ACM, 2015, pp. 134–139.

WORKSHOP PRESENTATIONS

- **F. Shmarov**, P. Zuliani, G. Smith, N. Reynolds. "A Mechanistic Model of Psoriatic Epidermis and Psoriasis Therapies". *Poster session at MRC PSORT consortium showcase, 2019.*
- **F. Shmarov**. "Probabilistic Bounded Reachability for Stochastic Hybrid Systems". *Third Workshop on Design and Analysis of Robust Systems (DARS), 2018.*
- **F. Shmarov** and P. Zuliani. "ProbReach: Probabilistic Bounded Reachability for Uncertain Hybrid Systems". *International Workshop on Formal Methods for Rigorous Systems Engineering of Cyber-Physical Systems (RiSE4CPS), 2017.*
- **F. Shmarov**. "Stochastic Hybrid Systems: Modelling Cancer and Psoriasis". *International Workshop on Automated Reasoning for Systems Biology and Medicine (ARSBM), 2016.*

TECHNICAL SKILLS

- C/C++, Java, Python, R, MATLAB, SQL, Git, HPC, AWS
- Linux, Windows, OS X

SOFTWARE TOOLS

- ProbReach (https://github.com/dreal/probreach) - tool for formal and statistical verification of stochastic parametric hybrid systems.
  - Role: main developer
  - Language: C/C++
- BioPSy (https://github.com/dreal/biology) - tool for parameter set synthesis in dynamical systems.
  - Role: co-developer
  - Language: C/C++, Java
- System for area planning (https://github.com/shmarovfedor/area-planning) - tool for maximising the construction profit for some predefined region (MSc project).
  - Role: sole developer
  - Language: Java

TEACHING EXPERIENCE

- As Research Associate I have co-supervised 1 BSc student (who implemented an extension to my tool ProbReach as a part of the final project) and 6 Bioinformatics MSc students.
- As PhD student I demonstrated and marked assignments for 6 different BSc and MSc modules:
  - CSC1021 "Programming I",
  - CSC8105 "System Validation",
  - CSC3324 "Understanding Concurrency",
  - CSC1025 "Mathematics for Computer Science",
  - CSC8317 "Introductory Programming for Biologists",
  - CSC1024 "Computer Architecture".

PERSONAL SKILLS

- Experienced public speaker and presenter
- Ability to work in a team
- Supervisory skills
- Languages: English (fluent), Russian (native)